REMARKS

In the Office Action dated December 4, 2005, the Examiner noted that claims 1 through 20 are pending in the application; claims 1 through 20 stand rejected. The Examiner's rejections are respectfully traversed below.

Claim Rejections Under 35 U.S.C. 102

Claims 1-5, 7-14 and 15-20 were rejected under 35 U.S.C. 102(b) as being clearly anticipated by Lewis 3,014,675. Applicants contend that the present invention differs significantly from Lewis and is not anticipated.

With respect to Claims 1-5, 7-14 and 15-20 Lewis teaches of controlling flow using a traditional control surface. Lewis illustrates the use of a traditional airfoil 23 to control flow. Lewis as shown in FIG. 3 varies the angle (or movement) of the surface depending on drag and inertia of an aerial vehicle. This differs significantly from the present invention's devices used to control flow and flow separation on a missile or aircraft afterbody or its control surfaces. Claim 1, 7 and 15 provides for this control with "at least one activatable flow effector". (Application, pages19 and 20, Claim 1 and 7). An activatable flow effector is described as "electromechanical devices, which can be used to create disturbances in the flow over the surface of the missile or aircraft". (Application, page 7). Listed examples of activatable flow effectors include; "active vortex generators, which are deployable including but limited to flow deflectors, balloons, microbubbles and dimples or create active pressure active regions by suction or air pressure; synthetic jets including zero-net-mass synthetic jets; pulsed vortex generators; directed jets; vortex generating devices (fluidic and mechanical) plasma actuators including weakly ionized plasma actuators; wall turbulators; porosity including but not limited to reconfigurable, inactive and active; microactuators; and thermal actuators." (Application, pages 7-8). Micro vortex generators control flow detachment over the control surface by producing miniature, controlled tornadoes, called "vortices". The micro vortex generators sweep away uncontrolled airflow separation over the airplane or missile's wings and flaps with the benefit of reduced drag increased lift and increased control of the aircraft or missile. These benefits lead to less engine power needed to produce the same lift as traditional control surfaces. Traditional control surfaces, such as those used by Lewis have many disadvantages as described by the present

application; "These [traditional] control surfaces require a significant payload and volume to house the control actuation system... which includes heavy servomotors, thereby imposing significant limitation on the aircraft or missile aerodynamic performance." (Application, page 1). The present invention is specifically designed to be an alternative to conventional control surfaces described in Lewis, such as airfoils and flaps.

Additionally, with respect to Claims 1-5, 7-14 and 15-20, Lewis' airfoil (or flap) and sensor are not located on the "missile or aircraft afterbody" as claimed (Application, page 19, Claim 1). Lewis, places the sensor on the forebody to detect drag on the forebody, which in part controls an airfoil or flap in the near vicinity on the aerial vehicle (Col. 2, Lines 43-46).

Additionally, with respect to Claims 1-5, 7-14 and 15-20, Lewis does not teach or disclose activating and deactivating the at least one activatable flow effector based on at least in part the electrical signal of the at least one sensor. Instead Lewis discloses the use of a drag sensor with a mechanical output, which in part controls an airfoil or flap. In addition, the airfoil or flap in Lewis apparently is never deactivated but rather operates constantly as a control surface. Lewis uses a traditional control surface such as a rotatable airfoil. This airfoil does not activate and deactivate to control flow separation as does the present invention. Rather, the airfoil operates proportionally to the flow detection signal to increase and decrease the amount of deflection away from the surface of the aerial vehicle. (Column 3, Lines 10-17).

With respect to Claims 2 and 11, Lewis clearly does not teach or disclose commanded forces on a missile or aircraft afterbody as claimed. Instead the control surface in Lewis is adjusted during a roll of the aerial vehicle. When the aerial vehicle in Lewis is not in a roll condition, the control surface is in its mid-position not deactivated (Column 3, Lines 51-54).

With respect to Claim 3 and 16, it is also clear that Lewis does teach or disclose a closed loop control system that activates the at least one activatable flow effector by oscillation or a method that activates at least one activatable flow effector by oscillation. Lewis states that the control surface operates proportionally to the output signal of the gyroscope "which produces a voltage proportional to the deflection of the gyroscope from its at-rest position". (Column 3, Lines 12-14). This illustrates how the airfoil in Lewis controls flow by proportionally deflecting fluid based on the output of a gyroscope, rather than the oscillation described in the present invention. Even if the conditions through which the missile travels oscillate, as the Examiner proposes, the airfoil would most likely proportionally deflect from minimum to maximum

through the entire range of angles. This differs from the present invention which would alternate between the "on" and "off" positions with no substantial time at intermediate values.

With respect to Claims 4, 9, and 17, Applicants contend that Lewis neither discloses nor teaches activating at least two flow effectors in a pattern, as claimed. Further, Lewis does not teach of using at least two or more flow effectors in any form whatsoever, particularly in a pattern as claimed.

With respect to Claim 5, it is clear that Lewis does not teach a pressure sensor as claimed, but rather using a drag sensor.

With respect to Claim 7, it is clear Lewis does not teach of putting an activatable flow effector on a tail fin or boattail of a missile or aircraft as claimed. Rather, Lewis teaches the use using traditional control surfaces such as flaps or air foils to control flow on the forebody or mid-section of an air vehicle, and certainly activatable flow effectors on boattails or tail fins to augment these flow control surfaces.

With respect to Claim 10, Applicants contend that Lewis does not teach of activating and deactivating its flow effector at frequencies of at least 20 Hz. Lewis teaches of using a traditional flow control system which adjusts the configuration of the control surfaces according to the position of the missile and drag conditions. The traditional flow control system in Lewis does not rely on cycling flow effectors between activated and deactivated positions. Furthermore, altering the configuration of traditional control surfaces such as air foils, flaps, etc. at a rate of at least 20 Hz would most likely cause severe damage to the control surfaces and missile itself, likely resulting in a crash.

With respect to Claims 12 and 19, Lewis does not teach a closed loop control system to activate and deactivate at least one activatable flow effector to create in part a yawing moment on the missile or aircraft. Rather, Lewis discloses the use of a traditional surface for yaw stabilization.

With respect to Claims 13 and 20, Lewis does not teach a closed loop control system to activate and deactivate at least one activatable flow effector to create in part a pitching moment on the missile or aircraft. Rather, Lewis discloses the use of a traditional surface for pitch stabilization.

With respect to Claims 14 and 18, Lewis does not teach a closed loop control system to activate and deactivate at least one activatable flow effector to create in part a rolling moment on

the missile or aircraft. Rather, Lewis discloses the use of a traditional surface for rolling stabilization. Given the reasons in this response, the Applicants respectfully request withdrawal of this rejection.

Claim Rejections Under 35 U.S.C. 103

Claim 6 is rejected under 35 U.S.C. 103(b) as being obvious over Lewis 3,014,675 in view of Malmuth et al. 6,805,325 ('325) or Malmuth et al. 6,796,532 ('532). Applicants submit that in light of the differences between the present invention and Lewis and Malmuth et al., the Examiner has not established a prima facie case of obviousness.

In addition to the above comments with respect to Lewis, with respect to Claim 6, neither of the Malmuth et al. patents teach of placing a plasma actuator on the aircraft or missile afterbody. Malmuth '532 teaches of "controlling vortex symmetry or asymmetry on aircraft forebodies". ('532 abstract). While the Malmuth '325 patent teaches of a "method for controlling leading edge contamination and crossflow instabilities". ('325 abstract). It is clear that neither of these references teach nor contemplate using plasma actuators on an aircraft or missile afterbody. The combination of the Malmuth patents with Lewis, both of whom put control surfaces on the forebody, teaches away from the present invention's teaching of placing flow effectors on the afterbody of a missile or aircraft. In addition, none of the references teach of a pressure sensor with an electrical signal or locating of pressure sensors on the missile or aircraft afterbody.

The Applicants further submit that the Examiner has not given any reason, suggestion, or motivation in the references, or from the references cited as a whole for the person of ordinary skill to have combined or modified the references. The Applicants submit that obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching suggestion or incentive supporting such combination. If such suggestion or incentive is in the references, the Applicants respectfully request that the Examiner particularly point out the relevant sections of those references cited which suggest or motivate the combination of those references, particularly given the large differences in the types of devices described by these two references and their applications. If the Examiner is alleging that a person of ordinary skill would have be motivated to combine such references, the Applicant respectfully submits that how a person of ordinary skill in the art would have been motivated must be in the personal knowledge of the Examiner, and therefore respectfully requests that the

Examiner in the next Official Action submit an affidavit detailing as specifically as possible such motivation (see 37 CFR §1.104 (d) (2)).

Conclusion

For all the above reasons, the Applicants respectfully submit that this application is in condition for allowance and that action is earnestly solicited.

Respectfully submitted,

2/3/06

Dated

Brian M. Kolkowski
Reg. No.: 36,847
Attorney for the Applicants
Orbital Research Inc.
4415 Euclid Avenue, Suite 500
Cleveland, OH 44103
(216) 649-0376
Fax (216) 649-0347
Email: kolkowski@orbitalresearch.com